

AMENDMENTS TO THE CLAIMS

1-24. (cancelled)

25. (currently amended) An optical measurement and inspection method comprising:

providing at least two light emitters,

providing at least one light receiver,

providing at least one signal generator connected to at least one of the light ~~emitter~~ emitters and at least one of the light ~~receiver~~ receivers, and

providing means for converting the received light to electrical current, ~~characterised in that,~~ wherein

[[~~-~~]] providing a sheet of material that lies or traverses between and/or in front of the at least two light emitters and the at least one light receiver (200),

[[~~-~~]] controlling, with the at least one signal generator, ~~controls~~ at least one of the light ~~emitter~~ emitters and the at least one light receiver by sending them an electronic synchronisation signal and thereby synchronises [[~~the~~]] emission and detection of light rays (205, 215, 245),

fixing a common carrier waveform AC voltage signal in frequency, and a symmetrical 50% duty cycle square wave signal is processed from the common carrier waveform signal and carries equal frequency and phase in terms of zero-crossings,

[[~~-~~]] driving, with the at least one signal generator, ~~drives the~~ at least two light emitters with different carrier

frequencies waveforms and/or phases, and the at least one light receiver with both of these frequencies, waveforms and/or phases,

[[~~-~~]] emitting, with the at least two light emitters, ~~emit~~ at least two rays of light (220),

[[~~-~~]] the at least two rays of light being ~~[[are]]~~ incident on the stationary or traversing sheet (225),

[[~~-~~]] detecting by the same light receiver (230) at least two ~~grazing, transparent and/or reflected rays of light from the sheet~~ rays of light grazing the sheet, transparent to the sheet, reflected from the sheet or directly from the light emitters ~~are detected by the same light receiver (230),~~

[[~~- the~~]] an intensity of at least one said emitted ray of light follows ~~[[a]]~~ the carrier waveform signal and at least one ~~received~~ said detected light ray is demodulated from the carrier waveform signal using the electronic synchronisation signal,

[[~~-~~]] converting at least two of the rays of light ~~are converted~~ to photocurrent (240), and the symmetrical square wave signal, processed from the common carrier waveform signal, is used for rectifying photocurrent signal,

removing at least one DC component from the photocurrent signal, and

[[~~-~~]] diagnosing and observing the processed photocurrent and/or changes in the processed photocurrent ~~are diagnosed and observed~~ to find defects and/or determine characteristics of the said sheet of material (250),

wherein at least one said carrier waveform signal is a sine wave, cosine wave, or a square wave signal.

26. (currently amended) [[An]] The optical measurement and inspection method in accordance with claim 25, ~~characterised in that,~~ wherein different ~~beams~~ rays of light from different emitters targeted to the same receiver measure different properties of the material sheet.

27. (currently amended) [[An]] The optical measurement and inspection method in accordance with claim [[25]] 26, ~~characterised in that,~~ wherein the three dimensional structure of a defect is detected with more than one ~~beams~~ of the rays of light.

28. (canceled)

29. (currently amended) [[An]] The optical measurement and inspection method in accordance with claim 25, ~~characterised in that,~~ wherein the photocurrent is converted to a voltage.

30. (currently amended) [[An]] The optical measurement and inspection method in accordance with claim [[25]] 29, ~~characterised in that,~~ wherein the resulting photocurrent or voltage is amplified.

31. (currently amended) [[An]] The optical measurement and inspection method in accordance with claim 25, ~~characterised in that,~~ wherein the resulting photocurrent or a voltage converted from the photocurrent is fed into a fault detection circuit (80) that ~~comprises,~~ comprises:

- means for summing 820, 823 a positive or negative threshold voltage value to the voltage signal entering the fault detection circuit,

- a low pass filter signal path (825),

- means for resetting the circuit ~~(850).~~ (850),

- means for generating digital defect signal pulses 840, 843 when analog signals exceeding preset threshold values are produced by [[the]] demodulation- or synchronised detection circuitry of the measurement and inspection ~~or measurement system,~~ method.

32. (currently amended) [[An]] The optical measurement and inspection method in accordance with claim 25, ~~characterised in that,~~ wherein the sheet material (410, 510, 610, 710) is paper, steel, plastic, metal, rubber, aluminium foil, copper foil, film, or coated metal sheet.

33. (currently amended) [[An]] The optical measurement and inspection method in accordance with claim 25, ~~characterised in that,~~ wherein [[the]] location and/or size of at least one defect and/or other attributes of at least one defect and/or

sheet width, thickness, length, density, reflectivity, purity or other physical attributes of the sheet are derived from ~~the said~~ optical measurements performed by the method.

34. (currently amended) [[An]] The optical measurement and inspection method in accordance with claim 25, ~~characterised in that,~~ wherein the arrangement is configured to detect one or more defects that may feature aspects of the following: holes, pinholes, scratches, spots, stains, cracks, edge faults, streaks, or surface faults.

35. (currently amended) [[An]] The optical measurement and inspection method in accordance with claim 25, ~~characterised in that,~~ wherein at least one light detector (520, 570, 720) and/or detector module (430, 560, 630) and/or detector array (420, 620) comprises at least one photoelectric device (530, 730), lens (550, 750) and/or wave guide (540, 740).

36. (currently amended) [[An]] The optical measurement and inspection method in accordance with claim 25, ~~characterised in that,~~ wherein the signal generator drives at least two light receivers with different carrier frequencies, waveforms and/or phases.

37. (currently amended) An optical measurement and inspection arrangement, comprising:

at least two light emitters,

at least one light receiver,

at least one signal generator connected to at least one of  
the light ~~emitter~~ emitters and at least one of the light ~~receiver~~  
receivers, and

means for converting the received light to electrical  
current, ~~characterised in that,~~ wherein

- a sheet of material (410, 510, 610, 710) is arranged  
between and/or in front of the at least two light emitters (400,  
500, 600, 700) and the at least one light receiver (420, 520,  
620, 720),

- the at least two light emitters (400, 500, 600, 700) are  
arranged to emit at least two rays of light incident on at least  
one sheet,

- ~~said~~ at least two ~~grazing, transparent and/or reflected~~  
~~rays of light~~ rays of light grazing the sheet, transparent to the  
sheet or reflected from the sheet are arranged to be detected by  
the same at least one light receiver (420, 520, 620, 720),

- at least one ray of light is arranged to be converted to  
photocurrent by at least one photoelectric device (530, 630, 730)

- the at least one signal generator is arranged to control  
at least one of the light ~~emitter~~ emitters (400, 500, 600, 700)  
and at least one of the light ~~receiver~~ receivers (420, 520, 620,  
720) by sending them an electronic synchronisation signal and  
thereby synchronises the emission and detection of rays,

- a common carrier waveform AC voltage signal is fixed in frequency, and a symmetrical 50% duty cycle square wave signal is processed from a common carrier waveform signal and carries equal frequency and phase in terms of zero-crossings,

- the at least one signal generator is arranged to drive the at least two light emitters with different carrier frequencies, waveforms and/or phases, and the at least one light receiver with both of these frequencies waveforms and/or phases,

- ~~[[the]]~~ an intensity of at least one said emitted ray of light is arranged to follow a carrier waveform signal and at least one received light ray is arranged to be demodulated from the carrier waveform signal using the electronic synchronisation signal,

- the symmetrical square wave signal, processed from the common carrier waveform signal, is used for rectifying photocurrent signal,

- at least one DC component is removed from the photocurrent signal, and

- the photocurrent and/or changes in photocurrent are arranged to be diagnosed and observed to find defects and/or determine characteristics of the said sheet of material (310), wherein at least one of said carrier waveform signal is a sine wave, cosine wave, or a square wave signal.

38. (currently amended) ~~[[An]]~~ The optical measurement and inspection arrangement in accordance with claim 37 characterised

~~in that,~~ 37, wherein different ~~beams~~ rays of light from different emitters arranged to be targeted to the same receiver are arranged to measure different properties from the material sheet.

39. (currently amended) ~~[[An]]~~ The optical measurement and inspection arrangement in accordance with claim ~~37 characterised~~ ~~in that,~~ 37, wherein a ~~[[the]]~~ three dimensional structure of a defect is arranged to be detected with more than one ~~beams~~ of the rays of light.

40. (canceled)

41. (currently amended) ~~[[An]]~~ The optical measurement and inspection arrangement in accordance with claim ~~37 characterised~~ ~~in that,~~ 37, wherein the resulting photocurrent or a voltage converted from the photocurrent is fed into a fault detection circuit (80) that comprises,

- means for summing a positive or negative threshold voltage value to the voltage signal entering the fault detection circuit 820, 823.

- a low pass filter signal path (825),

- means for resetting the circuit ~~(850)~~ (850), and

- means for generating digital defect signal pulses 840, 843 when analog defect signals exceeding preset threshold values are produced by ~~[[the]]~~ demodulation- or synchronised detection



circuitry of the measurement and inspection ~~or measurement system~~  
arrangement.

42. (currently amended) [[An]] The optical measurement and inspection arrangement in accordance with claim 37 ~~characterised in that,~~ 37, wherein the sheet material (310, 410, 510, 610) is paper, steel, plastic, metal, rubber, aluminium foil, copper foil, film or coated metal sheet.

43. (currently amended) [[An]] The optical measurement and inspection arrangement in accordance with claim 37 ~~characterised in that,~~ 37, wherein [[the]] a location and/or size of at least one defect and/or other attributes of at least one defect and/or sheet width, thickness, length, density, reflectivity, purity or other physical attributes of the sheet are derived from ~~the said~~ optical measurements performed by the arrangement.

44. (currently amended) [[An]] The optical measurement and inspection arrangement in accordance with claim 37 ~~characterised in that,~~ 37, wherein the arrangement is configured to detect one or more defects that may feature aspects of the following: holes, pinholes, scratches, spots, stains, cracks, edge faults, streaks, or surface faults.

45. (currently amended) [[An]] The optical measurement and inspection arrangement in accordance with claim 37 ~~characterised~~

~~in that,~~ 37, wherein at least one of said light receivers and/or ~~detector~~ means for converting the received light (420, 520, 560, 570, 620, 630, 720) comprises at least one photodetector (530, 730), lens (550, 750) and/or wave guide (540, 740).

46. (currently amended) ~~[[An]]~~ The optical measurement and inspection arrangement in accordance with claim 37 ~~characterised in that,~~ 37, wherein the signal generator is arranged to drive at least two light receivers with different carrier frequencies, waveforms and/or phases.